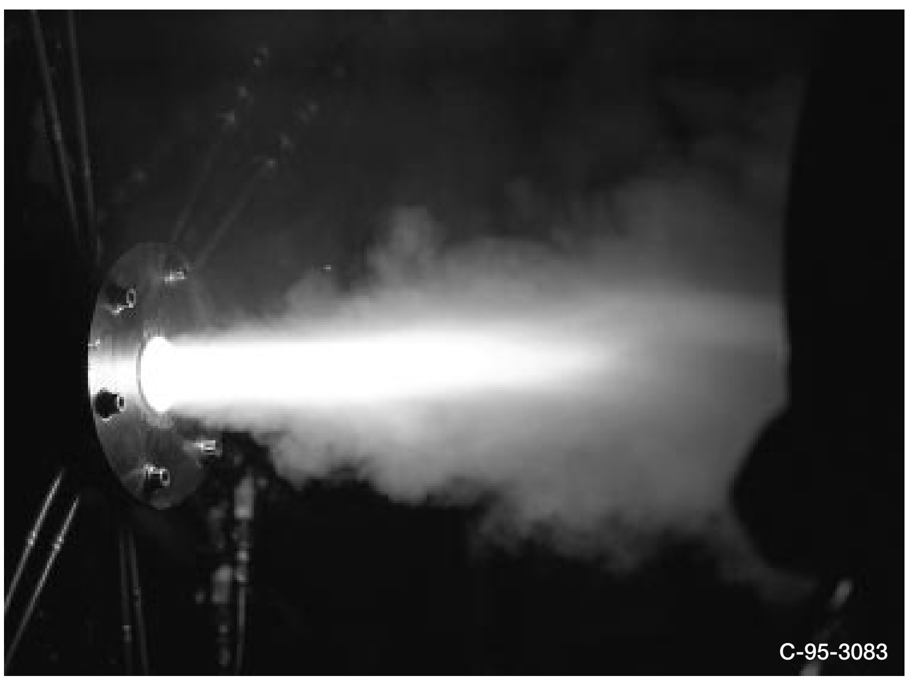
Technology Opportunity

New Fuels and Space Propellants for Safer, Lower Cost Flight

This focused SBIR topic is designed to foster the development of rocket propellants and aircraft fuels that have a higher density and specific impulse and are easier to handle. Many challenges have been overcome recently in the discovery and synthesis of propellants that offer higher performance than the traditional oxygen/hydrogen, oxygen/RP-1, and aircraft fuels. This focused SBIR topic will provide a substantial infusion of resources to enable the commercialization of these fuels and propellants for aeronautics and space applications. Through it, monopropellants that are self-pressurizing and less toxic and that have the performance of bipropellant nitrogen tetroxide and monomethyl hydrazine will be developed. In addition, denser, gelled propellants and fuels that increase safety will be developed.

- Examples of such monopropellants are mixtures containing
    - nitromethane
    - nitrous oxide
    - hydroxyl ammonium nitrate
    - aluminum
    - water
    - gelling agents
    - and/or other species
    - (this list is not all-inclusive)
- Future high-energy propellants include such compounds as
    - cubane
    - strained-ring compounds
    - polymeric oxygen
    - polymeric nitrogen
    - analogs of prismane



Gelled rocket propellant test firing at NASA Lewis.

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Potential Commercial Uses

- Particle formation
- Paint additives
- Racing fuel additives
- Cryogenic liquid and solid storage systems
- Cryogenic coolers
- Combined solid-liquid gas flow systems
- Rocket propellant formulations

Benefits

- Higher fuel performance
- Greater fuel safety
- Longer lived coatings
- High-temperature coatings (for engines)
- Vibration isolation
- Longer lived cryogenic storage
- Cheaper payload delivery to orbit

The Technology

Some of the areas of interest to industry partners are linked to the fuel formulations and the technologies associated with them. These areas are in cryogenics, cryocoolers for ground-based applications, particle formation for paint additives and reflective surfaces, slurry flows for coal and the like, and racing fuel additives. There will also be commercial use in high-power amateur rocketry.

The higher performing propellants can be applied as high-density monopropellants for the upper stages in rockets and for onboard propulsion in small spacecraft. Higher energy fuels, such as polymeric oxygen and nitrogen and the like would be applicable to space launch vehicles. This SBIR focused topic will promote the development and demonstration of self-pressurizing and less toxic propellants that have the performance of nitrogen tetroxide/monomethyl hydrazine. Examples include mixtures of nitromethane, nitrous oxide, hydroxyl ammonium nitrate, ammonium nitrate, aluminum, and/or other species.

The SBIR will also promote development of high-energy molecules, whether monopropellant or bi-propellant, that offer the performance of oxygen and hydrogen while offering significantly higher system density. Possible examples include polymeric oxygen and nitrogen and prismane. With these denser, more viscous propellants and fuels, flight system safety will be increased. Aeronautical uses are directed toward improving the storage density in comparison to typical jet fuels and investigating related research in endothermic fuels. These fuels and their commercialization will be the major products of the SBIR topic.

Options for Commercialization

NASA Space Act Agreements with NASA Centers Lewis, Langley, Ames, and Johnson can be arranged. Potential SBIR partners and their area of interest are

- SRI International, Menlo Park, CA—fuel additives
- Orbital Technologies Corp., Madison WI—cryogenics
- Sigma Labs, Tucson, AZ—particle formation
- U.S. Air Force:
  Phillips Laboratory, Edwards, CA— high-energy molecules
  Wright Laboratory, Wright Patterson Air Force Base, Dayton, OH—endothermic fuels
- U.S. Navy:
  The Naval Air Warfare Center, China Lake, CA—monopropellants
- U.S. Army:
  The Missile Command, Huntsville, AL—gelled fuels

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